ISS and Human Research Project Office Highlights
March 5, 2010

ISS Research Program

FIR/LMM begin powered operations on ISS.

The Fluid Integrated Rack (FIR) and the Light Microscopy Module (LMM) began powered operations on ISS on March 3 and 4, 2010. The FIR/LMM operations team was given a continuous operational window and used the time to successfully complete the FIR functional test and 90 percent – 95 percent of the LMM functional checkout. All the LMM functional testing that was completed was successful. The LMM subsystems were able to receive and respond to the unlinked commands. LMM testing will continue on March 10, 2010 using the test target to quantify the vibration environment at 50x magnification. The FIR/LMM development, science, and operation teams are to be congratulated. This is the culmination of many years of hard work. If voluntary science is approved for March 13. 2010 to install the first 30mm Pentane module, science operations with the Constrained Vapor Bubble (CVB) module may start as early as the week of March 14. (POC: MAH/Ronald Sicker, (216) 433-6498)

Improvements made in Flame Extinguishment Experiment-2 (FLEX-2) Hardware.

The new Image Processing and Storage Unit (IPSU) and High Bit Depth/Multispectral Imaging Package (HiBMS) for FLEX-2 are going through Electromagnetic Interference (EMI) and thermal environments testing over the next two weeks. The Fuel and Oxidizer Management Assembly (FOMA) will undergo EMI testing the week of March 15, 2010. An absorber test is to be set up to ensure that glycerol fuel, if not completely oxidized during an on-orbit burn in the FLEX, will not impinge on the ISS vent system. POC: MAH/J. Mark Hickman, (216) 977-7105)

Critical Design Review held for FLEX-2

The Critical Design Review for the Flame Extinguishment Experiment-2 (FLEX-2) was held on February 25, 2010. Six Requests for Action (RFA) were submitted. The first three RFAs dealt directly with the hardware design and procedures. The first RFA was concerned with the maturity of the igniter design and the level of testing. Furthermore, it was recommended that a heat treatment method be developed and employed to ensure structural integrity during operations. The second RFA concerned removal and control of unused or unburned glycerol fuel that could be accidentally introduced into the ISS vent system. The third RFA asked for procedures for the mixing of pure and bi-component fuels and the procedure to fill the fuel reservoirs. The last three RFAs dealt with documentation. The fourth RFA was a request for a Safety Verification Tracking Log. The fifth RFA requested a technical memorandum to document software tests and updates that were referenced in the presentation. The last RFA concerned the Science Requirements Document, that the SRD test matrix should include a test matrix that can be accomplished within planned resources, that the test conditions should be prioritized, and that the Principal Investigators should sign the SRD. An out briefing of the CDR is to be held on March 4, 2010. (POC: MAH/J. Mark Hickman, (216) 977-7105)

Fluid sample vials filled for InSPACE-3 flight experiment

On March 2-3, 2010, a new set of flight vials were filled and sealed for the Investigating the Structure of Paramagnetic Aggregates from Colloidal Ellipsoids-3 (InSPACE-3) flight experiment. A previous set had been filled in July and August, 2009, but later encountered aggregation problems of the colloid particles in the fluid. The PI delivered a new set of fluid samples, with particles processed using a different method to the eliminate particle aggregation problem.

Approximately 32 capillary glass vials containing three different flight fluid samples were filled. Each different flight sample fluid contained ellipsoid-shaped polystyrene colloidal particles of varying aspect ratio (2:1, 3:1, and 4:1). The vials were sealed using a fusing method, i.e. utilizing an acetylene mini-torch, a newly implemented sealing method for InSPACE-3 to solve leakage problems encountered with the InSPACE-2 vials, sealed using an epoxy. This complete set of vials will be evaluated and tracked for any fluid evaporation losses over the next three months, along with inspection. The objective of the InSPACE-3 experiment is to continue InSPACE-1 and InSPACE-2 studies to determine the lowest energy configurations of the three dimensional structures of a magnetorheological (MR) fluid in a pulsed magnetic field. In particular, InSPACE-3 will investigate 3-D structures formed by non-spherical super-paramagnetic colloidal particles in these pulsed magnetic fields. (POC: MAH/Nancy R. Hall (216) 433-5643)

In-SPACE-3 capillary vial being filled with a syringe by GRC technician, Tim Dunlap (DMB).

Canadian Astronaut comments on working on BCAT experiment on ISS.
Canadian astronaut Bob Thirsk is featured in a SpaceRef[1] Canada story where he mentions how much he enjoyed working with the NASA/CSA Binary Colloidal Alloy Test-5 (BCAT-5)

experiment: "The most gratifying part of my Station experience has been the onboard research. One of the recent experiments I have operated is from Simon Fraser University. It is a colloidal engineering investigation called BCAT-5. Colloids are suspensions of tiny particles in a fluid, such as paint, ink, and even milk. The goal of BCAT-5 is to better understand the effect of phase separation on crystal growth. What we learn could improve the shelf-life of certain products and refine the manufacturing of plastics." [1]

The BCAT-5 experiment consists of ten small samples of colloidal particles. The ten BCAT-5 samples are contained within a small case the size of a school textbook. The experiment is currently setup on a handrail/seat track in the Japanese Experiment Module (JEM) of the International Space Station (ISS). Initially the samples are manually photographed for down-linking by the astronaut to scientists on the ground for analysis. Following configuration confirmation from investigators, the automated EarthKAM software is setup to take digital photographs of samples at close range for up to two weeks. Camera Control Files for running the EarthKAM software are uploaded from Earth to create movies that are taken with a time interval between frames selected by the scientists. In the case of the samples from Simon Frazer University, this time interval was changed and the experiment was rerun when exciting changes quickly occurred in this sample when it was run in the absence of gravity.

The BCAT-5 hardware supports four investigations; BCAT-5 Phase Separation studies collapse or phase separation rates that impact product shelf-life. The Simon Fraser University samples, BCAT-5 Compete, studies the competition between phase separation and crystallization, which is relevant in the manufacture of plastics. BCAT-5 Seeded Growth studies the properties of concentrated systems of small particles to evaluate if seed particles produce heterogeneous crystal growth. The last sample BCAT-5-3D-Melt will allow scientists to look at the mechanisms of melting using 3-dimensional temperature sensitive particles that that change size to form colloidal crystals and melt, depending on the ISS cabin temperature. In addition to providing new insights in fundamental science and test of new ideas in colloidal engineering, the information acquired by the BCAT experiments will help in the planning of the NASA GRC PACE/ACE experiments planned for 2010-2014. (POC: MAH/Donna Bohman (216) 433-8860); NCSER/William Meyer (216) 433-5011)

Ref 1. http://spaceref.ca/missions-and-programs/canadian-space-agency/return-to-earth-op-ed-by-canadian-astronaut-robert-thirsk.html

Presentation to Science Educators Council of Ohio Conference

Diane McElwain/NCSER and Nancy Hall/MAH made a presentation during a one-hour concurrent session at the Science Educators Council of Ohio (SECO) conference that was held in Columbus, Ohio on Feb. 25-26, 2010. Thirty-five educators were in attendance representing science educators, curriculum specialists, as well as college professors and representative from informal education venues such as the Challenger Center from Dayton, OH. The presentation titled: "NASA's Problem-Based Instructional Units (PBIU) for Physical Science." discussed and demonstrated NASA's online educational resources including the PBIU process. Throughout the conference, several networking opportunities were explored as a way to develop summer-professional development programs. In addition, we were able to connect with advertising opportunities that will allow us to get information about the summer GRC education programs to

science educators. (POC: MAH/Nancy R. Hall (216) 433-5643)

Human Research Program

GRC advancements in medical PRA presented to FAA.

On February 25, 2010, Dr. Jerry Myers presented Glenn Research Center (GRC) derived methods for performing high fidelity/simulation based Probabilistic Risk Analysis (PRA) of medical events to members of the Federal Aviation Administration, the US Army and US Coast Guard at the "Exploring Probabilistic Risk Assessment in Aeromedical Certification 2010 Workshop" in Oklahoma City, Oklahoma. The presentation was well received and several potential areas of collaboration were identified. A follow up meeting is planned for the AsMA conference in early May. Dr. Dan Dietrich presented the Portable Unit for Metabolic Analysis (PUMA), which quantifies exhaled gas content, volume, and temperature. In addition to using PUMA during microgravity exercise, Dr. Hamilton envisioned using PUMA as part of emergency treatment regimens, and as a way to quantify the effects of oxygen pre-breathe protocols prior to Extra-Vehicular Activity (EVA).. (POC: MAH/Jerry Myers (215) 433-2864)